What is claimed is:

1. A method comprising:

a) providing one or more coded oligonucleotide probes, each coded oligonucleotide probe comprising an oligonucleotide associated with at least one nanocode comprising a detectable non-encoding feature;

b) contacting a target nucleic acid with the one or more coded oligonucleotide probes; and

c) identifying coded oligonucleotide probes that bind to the target nucleic acid using scanning probe microscopy (SPM) to detect the nanocode and the detectable non-encoding feature.

2. The method of claim 1, wherein the one or more coded probes comprise substantially all possible sequences for a particular length of oligonucleotide.

3. The method of claim 1, wherein the nanocode is selected from the group consisting of carbon nanotubes, fullerenes, submicrometer metallic barcodes, nanoparticles and quantum dots.

4. The method of claim 1, wherein the nucleic acid is attached to a surface.

5. The method of claim 4, further comprising ligating adjacent coded probes that are hybridized to the nucleic acid.

6. The method of claim 5, further comprising separating ligated coded probes from the nucleic acid and non-ligated coded probes.

7. The method of claim 6, wherein the ligated coded probes form reading frames.

8. The method of claim 1, further comprising aligning the coded probes on a surface by molecular combing.

9. The method of claim 1, wherein the scanning probe microscopy is atomic force microscopy, scanning tunneling microscopy, lateral force microscopy, chemical force microscopy, force modulation imaging, magnetic force microscopy, high frequency magnetic force microscopy, magnetoresistive sensitivity mapping, electric force microscopy, scanning capacitance microscopy, scanning spreading resistance microscopy. tunneling atomic force microscopy or conductive atomic force microscopy.

10. The method of claim 2, further comprising determining the nucleotide sequences of oligonucleotides that bind to the nucleic acid.

11. The method of claim 10, further comprising determining a nucleotide sequence of the target nucleic acid from the sequences of oligonucleotides that bind to the nucleic acid.

12. The method of claim 1, further comprising identifying the target nucleic acid from the coded probes that bind to the nucleic acid.

13. The method of claim 1, wherein two or more target nucleic acids are present in a sample.

14. The method of claim 1, wherein at least two target molecules in the sample are analyzed at the same time.

15. The method of claim 1, wherein the detectable non-encoding feature is provided by a detectable feature tag associated with the nanocode.

16. The method of claim 15 wherein the detectable non-encoding feature tag comprises a start tag.

17. The method of claim 1, further comprising transforming the molecular nanocode to form a decompressed nanocode.

18. The method of claim 1, wherein the detectable feature is a checksum barcode segment.

19. The method of claim 1, wherein the detectable feature comprises a header segment and an encoding segment.

20. A composition comprising at least one coded probe, each coded probe comprising a probe molecule attached to at least one nanocode comprising a detectable non-encoding feature, the nanocode being detectable using a single molecule level surface analysis method.

21. The composition of claim 20, wherein the probe molecules is an oligonucleotide, a polynucleotide, a nucleic acid, an antibody, an antibody fragment, a genetically engineered antibody, a single chain antibody, a humanized antibody, a protein, a receptor, a transcription factor, a peptide, a lectin, a substrate, an inhibitor, an activator, a ligand, a hormone, a cytokine, a chemokine, or a pharmaceutical.

22. The composition of claim 20, wherein the probe molecule is an oligonucleotide.

23. The composition of claim 20, wherein the nanocode is selected from the group consisting of carbon nanotubes, fullerenes, submicrometer metallic barcodes, nanoparticles and quantum dots.

24. The composition of claim 20, wherein the detectable non-encoding feature is a start tag.

25. The composition of claim 20, wherein the nanocode is a compressed nanocode.

26. The composition of claim 20, wherein the nanocode comprises reading frames.

27. The composition of claim 20, wherein the nanocode comprises a header region and an encoding region.

28. The composition of claim 20, wherein the nanocode is detectable using scanning probe microscopy (SPM).

29. A system comprising:

a) a scanning probe microscope (SPM);

b) a surface; and

c) at least one coded oligonucleotide probe attached to the surface, wherein the coded oligonucleotide probe comprises a nanocode comprising a detectable non-encoding feature, the nanocode being detectable using SPM.

30. The system of claim 29, wherein the coded oligonucleotide probes comprise ligated oligonucleotides.

31. The system of claim 30, wherein the ligated oligonucleotides form reading frames.

32. The system of claim 29, wherein the scanning probe microscope is an atomic force microscope or a scanning tunneling microscope.

33. The system of claim 29, wherein the detectable non-encoding feature is a start tag.

34. The system of claim 29, wherein the nanocode is a compressed nanocode.

35. The system of claim 29, wherein the nanocode comprises reading frames.

36. The system of claim 29, wherein the nanocode comprises a header region and an encoding region.